TECHNICAL APPENDIX: CHAPTER IV

NPLOS SAMPLING DESIGN AND INSTRUCTION

Description of the Potential Respondent Universe

The objective of NPLOS is to survey a representative national sample of rural, private landowners of tracts larger than 10 acres. NPLOS sampling consisted of a two-stage process: 1) Determining which U.S. counties (not counting Alaska and Hawaii) are eligible for sampling and drawing a sample of counties from among those, and 2) Drawing a sample of landowners from within each of the sampled counties. The sample size of landowners to be surveyed was determined by working backwards from the desired number of 12,500 completed questionnaires to adequately describe the U.S. rural private landowner situation. Following the Dillman survey research method, a questionnaire return rate in the neighborhood of 50 percent is expected. Allowing for about 1,000 unusable surveys, this requires a sample size of 26,000 private landowners.

The number of counties to sample was determined by dividing 26,000 by the number of tracts to be sampled per county, 35. This yields 743 counties nationwide, which we rounded up to 750. The figure of 35 surveys per county is derived from four tract size categories per county. We want to ensure that sampled tracts are not all of a similar size, so four acreage categories were devised. These are: 10-19 acres, 20-99 acres, 100-499 acres, and 500 or more acres. The first three categories will have a sample of 10 tracts each per county. Given their relative scarcity, the 500+ acres category will have a maximum of 5 tracts per county. Many counties will sample fewer than 5 of these tracts. If a county has no tracts larger than 500 acres, obviously none can be sampled. Item 2 describes the process used for drawing the sample of landowners within each county.

The 750 counties selected for the sample were chosen in the following manner. First, we removed from consideration those counties that do not have the kinds of rural, private landowners that NPLOS seeks

to survey. These are primarily urbanized and highly developed counties or those dominated by public lands. Using U.S. Census data, urban or metropolitan counties were operationalized as those counties with a population density of 400 or more persons per square mile. These counties were immediately excluded.

The next decision rule to exclude counties from sampling consideration was: If a county's population density was between 300 and 400 persons per square mile, or the county's land base was 70 percent or more public land (federal or state) or urban "built up" land, unless the county had a sufficiently large amount of rural, private acres-- 140,000 in the eastern U.S. or 250,000 acres in the western U.S. (The eastern and western acreage figures represented the 95th percentile of rural, private, undeveloped acres among counties in those regions).

These counties were excluded because of the objective of sampling counties with a high percentage of rural, private and undeveloped tracts. A total of 220 counties (out of 3,082 U.S. counties) were excluded from the sampling universe of U.S. counties based on these criteria. That left 2,862 counties in the coterminous U.S. which were eligible for NPLOS sampling.

Needing a sample of 750 counties out of 2,862 eligible left a probability of being selected of about 1 in 4 (26.2 percent). We wanted to ensure that this probability was equally distributed across the 48 states. A simple random sample of the eligible counties may have produced some states with a disproportionate number selected and some states with none selected at all. So, the decision was made to treat the states as one strata or layer.

Next, a similar concern was that certain regions of states would be oversampled at the expense of other state regions. Rather than divide each state into geographic quartiles, the decision was made to sample proportionally based upon classified ecoregions (Source: Bailey's Ecoregions of the United States, 1976) within each state. Therefore, within each ecoregion in every state, roughly one-fourth of the eligible counties were randomly selected. Summed across all states, this resulted in approximately 750 selected counties from which to draw the sample of landowner tracts. The table below lists state, ecoregion and the number of eligible and selected counties from each.

State	Ecoregion	Eligible Counties	Selected Counties
AL	MIXED MESOPHYTIC FOREST	8	2
AL	BEECH-SWEETGUM-MAGNOLIA-PINE-OAK FOREST	10	3
AL	SOUTHEASTERN MIXED FOREST	48	13
AZ	CREOSOTE BUSH - BUR SAGE	4	1
AZ	UPPER GILA MOUNTAINS FOREST	5	1
AZ	JUNIPER-PINYON WOODLAND/SAGEBRUSH MOSAIC	3	1
AR	OAK-HICKORY FOREST	25	7
AR	SOUTHERN FLOODPLAIN FOREST	20	5
AR	SOUTHEASTERN MIXED FOREST	28	7
CA	CALIFORNIA GRASSLAND	9	2
CA	SAGEBRUSH - WHEATGRASS	2	1
CA	CREOSOTE BUSH	4	1
CA	REDWOOD FOREST	4	1
CA	SIERRAN FOREST	14	4
CA	CALIFORNIA CHAPARRAL	7	2
CO	GRAMA-BUFFALO GRASS	22	6
CO	DOUGLAS FIR FOREST	26	7
CO	JUNIPER-PINYON WOODLAND/SAGEBRUSH MOSAIC	3	1
CT	NORTHERN HARDWOODS FOREST	5	1
DE	SOUTHEASTERN MIXED FOREST	2	1
FL	BEECH-SWEETGUM-MAGNOLIA-PINE-OAK FOREST	52	14
FL	EVERGLADES	2	1
GA	APPALACHIAN OAK FOREST	11	3
GA	BEECH-SWEETGUM-MAGNOLIA-PINE-OAK FOREST	63	17
GA	SOUTHEASTERN MIXED FOREST	72	19
ID	PALOUSE GRASSLAND	28	7
ID	DOUGLAS FIR FOREST	8	2
ID	GRAND FIR - DOUGLAS FIR FOREST	5	1
IL	MAPLE-BASSWOOD FOREST + OAK SAVANNA	2	1
IL	OAK-HICKORY FOREST	22	6
IL	OAK-HICKORY-BLUESTEM PARKLAND	72	19
IN	BEECH-MAPLE FOREST	60	16
IN	OAK-HICKORY FOREST	10	3
IN	OAK-HICKORY-BLUESTEM PARKLAND	20	5
IA	MAPLE-BASSWOOD FOREST + OAK SAVANNA	5	1
IA	OAK-HICKORY-BLUESTEM PARKLAND	47	12
IA	BLUESTEM PRAIRIE	46	12
KS	OAK-HICKORY-BLUESTEM PARKLAND	19	5
KS	OAK + BLUESTEM PARKLAND	3	1
KS	BLUESTEM PRAIRIE	20	5
KS	BLUESTEM-GRAMA PRAIRIE	47	12
KS	GRAMA-BUFFALO GRASS	13	3
KY	MIXED MESOPHYTIC FOREST	28	7
KY	OAK-HICKORY FOREST	86	23
LA	BEECH-SWEETGUM-MAGNOLIA-PINE-OAK FOREST	16	4
LA	SOUTHERN FLOODPLAIN FOREST	27	7

State	Ecoregion	Eligible Counties	Selected Counties
LA	SOUTHEASTERN MIXED FOREST	17	5
ME	NORTHERN HARDWOODS-SPRUCE FOREST	16	4
MD	APPALACHIAN OAK FOREST	6	2
MD	SOUTHEASTERN MIXED FOREST	11	3
MA	NORTHERN HARDWOODS FOREST	3	1
MA	APPALACHIAN OAK FOREST	2	1
MI	NORTHERN HARDWOODS-FIR FOREST	14	4
MI	NORTHERN HARDWOODS FOREST	41	11
MI	BEECH-MAPLE FOREST	22	6
MN	SPRUCE-FIR FOREST	15	4
MN	MAPLE-BASSWOOD FOREST + OAK SAVANNA	31	8
MN	BLUESTEM PRAIRIE	36	10
MS	OAK-HICKORY FOREST	4	1
MS	BEECH-SWEETGUM-MAGNOLIA-PINE-OAK FOREST	15	4
MS	SOUTHERN FLOODPLAIN FOREST	11	3
MS	SOUTHEASTERN MIXED FOREST	52	14
MO	OAK-HICKORY FOREST	46	12
MO	SOUTHERN FLOODPLAIN FOREST	7	2
MO	OAK-HICKORY-BLUESTEM PARKLAND	58	15
MT	GRAMA-NEEDLEGRASS-WHEATGRASS	30	8
MT	WHEATGRASS-NEEDLEGRASS	6	2
MT	CEDAR - HEMLOCK - DOUGLAS FIR FOREST	8	2
MT	DOUGLAS FIR FOREST	12	3
NE	BLUESTEM PRAIRIE	37	10
NE	WHEATGRASS-BLUESTEM NEEDLEGRASS	37	10
NE	BLUESTEM-GRAMA PRAIRIE	4	1
NE	WHEATGRASS-NEEDLEGRASS	13	3
NV	SAGEBRUSH - WHEATGRASS	14	4
NH	NORTHERN HARDWOODS-SPRUCE FOREST	10	3
NJ	APPALACHIAN OAK FOREST	4	1
NJ	SOUTHEASTERN MIXED FOREST	2	1
NM	GRAMA-BUFFALO GRASS	9	2
NM	GRAMA - TOBOSA	6	2
NM	PONDEROSA PINE - DOUGLAS FIR FOREST	6	2
NM	GRAMA-GALLETA STEPPE/JUNIPER-PINYON MOSAIC	10	3
NY	NORTHERN HARDWOODS FOREST	38	10
NY	NORTHERN HARDWOODS-SPRUCE FOREST	7	2
NC	APPALACHIAN OAK FOREST	20	5
NC	SOUTHEASTERN MIXED FOREST	72	19
ND	BLUESTEM PRAIRIE	29	8
ND	WHEATGRASS-NEEDLEGRASS	24	6
OH	MIXED MESOPHYTIC FOREST	14	4
OH	BEECH-MAPLE FOREST	41	11
OH	APPALACHIAN OAK FOREST	12	3
OH	OAK-HICKORY FOREST	9	2

State	Ecoregion	Eligible Counties	Selected Counties
OK	OAK-HICKORY FOREST	6	2
OK	SOUTHEASTERN MIXED FOREST	4	1
OK	OAK-HICKORY-BLUESTEM PARKLAND	8	2
OK	OAK + BLUESTEM PARKLAND	26	7
OK	MESQUITE-BUFFALO GRASS	10	3
OK	BLUESTEM-GRAMA PRAIRIE	14	4
OK	GRAMA-BUFFALO GRASS	7	2
OR	WILLAMETTE - PUGET FOREST	4	1
OR	PALOUSE GRASSLAND	12	3
OR	SITKA SPRUCE-CEDAR-HEMLOCK FOREST	13	3
OR	GRAND FIR - DOUGLAS FIR FOREST	6	2
PA	NORTHERN HARDWOODS FOREST	12	3
PA	MIXED MESOPHYTIC FOREST	3	1
PA	APPALACHIAN OAK FOREST	40	11
SC	NORTHERN HARDWOODS-SPRUCE FOREST	2	1
SC	BEECH-SWEETGUM-MAGNOLIA-PINE-OAK FOREST	2	1
SC	SOUTHEASTERN MIXED FOREST	41	11
SD	BLUESTEM PRAIRIE	15	4
SD	WHEATGRASS-BLUESTEM NEEDLEGRASS	33	9
TN	MIXED MESOPHYTIC FOREST	11	3
TN	APPALACHIAN OAK FOREST	24	6
TN	OAK-HICKORY FOREST	54	14
TN	SOUTHERN FLOODPLAIN FOREST	2	1
TX	BEECH-SWEETGUM-MAGNOLIA-PINE-OAK FOREST	5	1
TX	SOUTHEASTERN MIXED FOREST	28	7
TX	OAK + BLUESTEM PARKLAND	73	19
TX	MESQUITE-BUFFALO GRASS	39	10
TX	JUNIPER-OAK-MESQUITE	25	7
TX	MESQUITE-ACACIA	24	6
TX	GRAMA-BUFFALO GRASS	40	11
TX	TARBUSH-CREOSOTE BUSH	13	3
UT	BONNEVILLE SALTBUSH - GREASEWOOD	20	5
VT	NORTHERN HARDWOODS-SPRUCE FOREST	14	4
VA	MIXED MESOPHYTIC FOREST	3	1
VA	NORTHERN HARDWOODS-SPRUCE FOREST	29	8
VA	SOUTHEASTERN MIXED FOREST	56	15
WA	WILLAMETTE - PUGET FOREST	6	2
WA	PALOUSE GRASSLAND	5	1
WA	SAGEBRUSH - WHEATGRASS	7	2
WA	DOUGLAS FIR FOREST	9	2
WV	MIXED MESOPHYTIC FOREST	32	8
WV	APPALACHIAN OAK FOREST	22	6
WI	SPRUCE-FIR FOREST	4	1
WI	NORTHERN HARDWOODS-FIR FOREST	6	2

State	Ecoregion	Eligible Counties	Selected Counties
WI	NORTHERN HARDWOODS FOREST	25	7
WI	MAPLE-BASSWOOD FOREST + OAK SAVANNA	32	8
WY	GRAMA-NEEDLEGRASS-WHEATGRASS	22	6
Total			752

Procedures for the Collection of Information

Statistical methodology for stratification and sample selection: Information for the NPLOS will be collected from the 752 counties selected in the first stage of sampling. The combined tax digest of every one of these counties will serve as the NPLOS sampling frame from which individual tract owners will be randomly selected. All properties smaller than 10 acres were automatically excluded. Properties owned by government agencies or nonprofit organizations are not of interest to NPLOS and were also excluded from consideration. Business properties are of interest and were not excluded unless they are highly developed or built-up, such as a large plant or factory.

Four tract size categories were specified to ensure a representative sample of both larger and smaller tracts. These categories are: 10-19 acres, 20-99 acres, 100-499 acres, 500 or more acres. The sample was designed to select 10 tracts each from the first three categories and a maximum of 5 tracts from the 500+ acres category. If a county has none of the 500+ acre tracts, of course, none can be selected. If a county does have some of these tracts, then a minimum of one and a maximum of five will be selected.

District Conservationists (DC) of the USDA Soil Conservation Service will execute the sampling process by visiting the selected county tax offices, completing the sampling forms and mailing them to the USDA Forest Service in Athens, GA. A copy of the actual sampling instructions sent to the DCs follows.

The instructions make reference to a "FORM I" and a "FORM II". The former is the sampling form that the DCs fill out for each tract sampled. Note that there are three separate sets of sampling

instructions because of the different methods that county tax offices maintain their records. Instructions are given for alphabetic listings, for tax district or township listings, and for descending acreage listings.

FORM II is used for estimating the total number of eligible county tracts in each of the four acreage categories. This is used to derive sampling probability rates which, in turn, are used to weight the data so that they are generalizable to the state and national level. More detail on sampling rates follows the sampling instructions.

INSTRUCTIONS FOR COMPLETING FORM I

Which Tracts Are Eligible?

WHICH TRACTS ARE INCLUDED IN THE SAMPLE?

Tracts that are: 1) 10 acres in size or larger,

and

2) owned by individuals, family trusts, businesses, or corporations

WHICH TRACTS ARE NOT INCLUDED?

Tracts that are: 1) smaller than 10 acres in size,

or

2) owned by a local, county, state, or federal government agency or by a non-profit organization

How to Draw a Sample

IF THE TAX LISTINGS ARE ALPHABETICAL:

1. Begin in these alphabetical listings with tracts owned by persons whose last name begins with the same first letter as your last name. The first eligible tract you find is where you start. Remember, eligible tracts are those 10 acres or larger and owned by private individuals, families, businesses or corporations.

Exception: Do not include tracts listed to someone having the same home or tract address as the owner of a previously selected tract (e.g., a spouse or other family member).

2. Beginning at the first eligible tract, record the needed information on **FORM I**. From that first tract, move down the list one tract at a time recording the requested information for all eligible tracts you find. Remember, do not include land owned by governments or non-profit organizations. Select only those owned by private individuals, families or businesses that are 10 acres or larger.

   *** The objective of NPLOS is to survey rural, private landowners.

   Businesses are eligible, but do not include tracts that you know are developed or built-up land, such as factories or other industrial uses.

3. Proceed through the tax listing, reviewing each successive tract for eligibility. If a tract is not eligible, either because it is smaller than 10 acres, is owned by a person at a home or tract address already sampled, or is owned by government or a non-profit organization, simply go to the next entry as described in the step above.

4. Continue through the alphabetical tax listings until you have selected 10 tracts in each of the first three acreage categories. As soon as you have completed the required sample of 10 for any of these three categories, all tracts of that size, in effect, become ineligible. Move ahead to the next eligible tract until all three categories are filled.

Special directions for 500+ acres category

Record all of the eligible 500+ acre tracts that you come across while drawing the sample of 10 tracts for each of the other three categories. We have enclosed a single FORM I sheet for the 500+ acres category, which gives you space to record up to 5 tracts. Once you have selected 10 tracts in each of the other three categories, you also may stop recording 500+ acre tracts. Many counties will have very few (or perhaps none) of the largest size tracts. We don't expect you to leaf through the entire tax digest in search of these.

If you encounter no 500+ acre tracts while drawing your sample:

1) Ask the tax assessor if there are any such tracts in the county. If there are none, initial and check the box located just below your name on FORM I.

2) If the tax assessor says that there are indeed some 500+ acre tracts in the county, continue to search from the point in the listing where you stopped until you find and record just one of these large tracts.

IF THE TAX LISTINGS ARE BY TOWNSHIPS OR TAX DISTRICTS:

1. Divide the number of tracts we need in each acreage category (10 for the first three acreage categories and 5 for the 500+ acres category) by the number of townships/districts in your county. The result is the number of sample tracts that you will need to pull from each township/district.

   Example: Say your county has 5 townships. For the first three tract size categories, divide 10 by 5 which equals 2 tracts per township to sample. For the 500+ acres category, this would be 5/5=1 tract per township. If this number turns out to be a fraction (e.g., 3 townships, 10/3= 3.33 tracts per township) then round up to the next whole number (in this example to 4 tracts per township).

*** If your county has more than 10 townships or tax districts, draw just one tract from each district. Start with the township/district number that is the same as your birth month. Select one tract per township/district until you have recorded 10 tracts in the first three acreage categories and up to 5 for the 500+ acres category.

Example: Say your county has 25 townships or tax districts. If your birth month is September, begin with district number 9 and select one tract in each acreage category. Proceed through districts 10 through 18 as you did for district 9. If some districts have none of the largest size tracts, go on to the next district. Say your county has 15 districts and your birth month is 9. Sample one tract apiece from districts 9 through

15, then return to the first district and sample one tract each from districts 1, 2, and 3 for a total of 10 districts.

2. If the township or district tax rolls are listed alphabetically, draw your township/district sample using the earlier described procedures for alphabetical listings. Repeat for each township or tax district. Move on to the next township/district when you have recorded the required number of tracts (from step 1). You should have at least 10 tracts for the first three acreage categories once you have finished sampling the townships or tax districts. Record up to 5 tracts total from the 500+ acres category if you encounter them during sampling. If there are no 500+ acre tracts in your county, initial and check the box located just below your name on FORM I.

IF THE TAX LISTINGS ARE BY DESCENDING ACREAGE:

1. A sampling interval is needed for this type of listing. Begin by counting or closely approximating the number of tracts in each of the four acreage categories.

2. Divide the total number of tracts in each of the first three acreage categories by 10 (divide by 5 in the 500+ acres category) and round down to the nearest whole number to derive the sampling interval for that tract. Each acreage category has its own sampling interval.

   Example: If the 10-19 acre category has 456 tracts, the sampling interval for that category is 456/10 = 45.6 or 45. If the 500+ acre category has 23 tracts, the sampling interval is 23/5= 4.6 or 4. Repeat this process for each acreage category.

3. Beginning with the 10-19 acre category, choose any number within the sampling interval as your starting point. For example, if the interval is 46, select any number between 1 and 46 and start with that tract, counting from the first tract. From there, select every 46th eligible tract, where 46 is the sampling interval.

4. Repeat this process for each of the four acreage categories. To derive the sampling interval, divide the total number of tracts in each acreage category by a) 10 for the first three categories and b) 5 for the 500+ acres category. Select tracts using the sampling interval in each of the four acreage

categories until you have recorded 10 tracts in the first three categories and five tracts in the 500+ acres category.

*** If the 500+ acres category has fewer than 5 tracts, include all of them in the sample. If there are no 500+ acre tracts in your county, initial and check the box located just below your name on FORM I.

Note: If your county's tax rolls are listed in a manner not described here and none of these instructions seem to apply, please call a member of the NPLOS Research Team: Claire Payne, Carter Betz, or Ken Cordell at (706) 546-2451.

What We Need To Know About Sampled Tracts

If you are not familiar with your county's tax records, ask the tax assessor for assistance. For example, be careful not to confuse acreage with the tract number. For each tract, please record the following on FORM I:

1. **Name**, **address**, and **telephone number** of owner.

   ** Absentee or non-local owners are eligible to be included in the sample. If you are unsure about the accuracy of an address, please try to verify it against another source. Be sure to not include government or non-profit organization properties. Also, do not include properties that are obviously heavily developed or built-up, such as factories.

   ** Telephone number is very important for purposes of non-response follow-up. If it is not listed in the tax digest, please attempt to obtain it from another source such as the county treasurer's office or telephone directory.

2. **Unique tract identification** to clearly indicate to the owner participating in this survey exactly which tract is being referenced. Enter as many of the following elements as available:

   A. Tract, parcel, or account number

B. Township, area, district or other local area name

C. Map number

D. Nearest highway, road or other landmark from which property is accessible

3. **Number of acres in tract**

4. **Assessed value** (if available, the value assigned for taxation).

** Be sure to enter the assessed value and not the fair market value. If your county only lists total assessed value for all land holdings of a single property owner who has more than one tract, please estimate the proportion of that total assessed value for the selected tract only.

5. **County millage rate**

** In some counties, the millage rate is uniform. In others it may be different between the county and municipalities. If possible, list the specific millage rate for each tract. If that is too difficult to obtain, list the base county millage rate.

***example of sampling form used by DCs

FORM I: NPLOS LANDOWNER SAMPLE SHEET

STATE:_____ COUNTY:_____ (or Parish)

YOUR NAME:_____ YOUR PHONE NO.:_____

10-19 Acres

Sample 1

1. Owner's (or company) name _____
   Mailing address _____
   _____ Phone No. (___)_____
2. Tract identifying information (fill in as many as possible):
   Tract, parcel or account number _____
   Township, area, or district name _____
   Map number _____
   Nearest highway, road or landmark_____
3. Acreage in Tract _____

4. Assessed value _____ 5. Millage Rate _____

Sample 2

1. Owner's (or company) name _____
   Mailing address _____
   _____ Phone No. ( ) _____
2. Tract identifying information (fill in as many as possible):
   Tract, parcel or account number _____
   Township, area, or district name _____
   Map number _____
   Nearest highway, road or landmark _____
3. Acreage in Tract _____
4. Assessed value _____ 5. Millage Rate _____

Estimation procedure:

The District Conservationists of the Soil Conservation Service are being asked to provide another piece of information in addition to completing the sampling forms of landowner tracts. FORM II is for the purpose of estimation, i.e., weighting the sample data to be representative of the population. FORM II provides an estimate of the total number of eligible tracts within each of the four NPLOS tract size categories. These numbers are necessary to derive a sampling rate (or similarly, the probability of being sampled) for each county. Each county will have a sample of 10 tracts from the first three acreage categories and up to 5 tracts from the 500+ acres category. Consider, for example, two counties, A and B. If County A has 100 eligible tracts in the 10-19 acres category and County B has 1000 eligible tracts, the probability of being sampled is much higher in County A (.10) than in County B (.01). Consequently, County B's data would be weighted at a factor ten times that for County A.

Specifically, the equation for weighting data within each county and acreage category is:

$$W_{ij} = (1/ (t_{ij}/T_{ij})) / 100$$

where: W_{ij} = weight of county I, tract size category j

t_{ij} = number of tracts sampled in county I, tract size category j. Should be 10 for tracts smaller than 500 acres, providing SCS District Conservationists complete sample form. Will vary for 500+ acres category.

T_{ij} = total number of eligible tracts in county I, tract size category j

Data weights ensure that tracts that have a different probability of being sampled are weighted differently. Those tracts with a higher probability of being sampled receive relatively smaller weights. Tracts with a lower probability of being sampled receive relatively larger weights. Instructions to District Conservationists for providing the estimated numbers that go in to calculating the data weights follows under "Instructions For Completing FORM II".

INSTRUCTIONS FOR COMPLETING FORM II

A good estimate of your county's total number of tracts in each of the four acreage categories is critical to your sample and to the entire survey. Without it, we cannot combine counties from across the U.S. or within a state to get a national or state picture of private landowner trends.

It is recommended that you count the tracts just after you have finished drawing your sample. If you try to count tracts at the same time that you draw the sample, you may encounter confusion, as we did. Rather than ask you to count all tracts, we are asking you to count a sample of 100 tracts, tallying by the acreage size categories. Next, and just as important, we need to know your best estimate of the percentage of the entire county tax digest that your count of 100 eligible tracts represents. Follow these detailed steps:

1. Begin at the same place in the tax digest that you started your sample (names starting with the first letter of your last name and the first eligible tract listed).

2. Count the first **100 eligible** tracts, tallying each one in the proper acreage category as you go. Use the boxes on FORM II provided for this purpose. Remember, eligible tracts are those 10 acres or larger and owned by individuals, family trusts, businesses or corporations. An example of how to record counts is shown on FORM II. Make a note of where you stopped when you reached the 100th eligible tract. This information will be needed in step 4. If there are fewer than 100 eligible tracts in your county, simply count them all and ignore Step 4.

3. Fill in the total number of eligible tracts tallied in each acreage category in the spaces under the column marked "**Totals**" on FORM II. These four totals will sum to 100. If there were no 500+ acre tracts enter a "0" for that category. The other three totals will still sum to 100.

4. Now, take a look at the number of pages in the tax digest that you had to leaf through in order to count your sample of 100 eligible tracts, that is, from the first eligible tract you started with to the 100th eligible tract where you stopped. Don't worry about counting the number of pages, simply observe the thickness. You may even want to measure this with a ruler. Because of the various ways that tracts are listed and the presence of ineligible tracts (especially those under 10 acres), this "thickness" will be different for every county in the U.S.

We need your **best estimate** of the proportion that this group of pages (or thickness) represents out of the total number of pages (or total thickness, if you will) in the entire tax digest. Please round your estimate to the closest 1 percent, not 5 or 10 percent. Record this estimate in the space provided at the bottom of FORM II.

FORM II: **NPLOS TALLY SHEET FOR COUNTING TRACTS**

STATE:_____ COUNTY (or Parish): _____

YOUR NAME:_____ YOUR PHONE NO.:_____

TAX OFFICE PHONE NO. _____

EXAMPLE:

Tract Size Category	**Number of Tracts**	**Total**
10-19 acres	|||| |||| |||| |||| |||| |||| |||| ||	37

Use tally boxes below and enter each category total in the blank at right.

Tract size Category	**Number of Tracts**	**Totals** (should sum to 100)
10-19 Acres		_____
20-99 Acres		_____
100-499 Acres		_____
500+ Acres		_____

PAGE "THICKNESS" ESTIMATE

Best estimate (to the nearest 1%) of the proportion of the entire tax digest that sampled count of 100 eligible tracts represents:

_____ percent

Degree of Accuracy Needed:

An estimated response rate of 50 percent should provide the accuracy necessary to describe national and state level trends in private landownership well within the range of the .05 level of statistical significance. A total of 12,500 completed surveys is the target number.

Unusual Sampling Problems:

Potential sampling problems which may raise questions among the SCS District Conservationists (DC) have been addressed in the Instructions For FORM I. Three separate sets of sampling instructions were included because of the different ways that counties maintain their tax records. The DCs are asked to use their discretion to exclude developed or built-up land from the sample, for example, a factory or industrial plant. We also ask to DCs not to include more than one family member in their county sample. Some families own numerous tracts which means the DCs only need to observe the landowner's name or home address to verify that a family member has not already been included.

Sampling Design for Ecoregion - Tract Size Strata Estimates and Final Weighting Procedures

The survey employed a two-stage sampling design for estimates of (1) population totals for the ecoregion-tract size strata (ie, total private acres) and (2) population averages on a land owner basis for the ecoregion-tract size strata (ie, average size tract per land owner which is reserved). For a given ecoregion-tract size stratum, let

N = total number of counties (primary units) in the stratum,

n = number of counties selected for sampling,

M_i = total number of land owners (secondary unit) in county I,

m_i = number of land owners sampled in county I (those who returned the questionnaire) and

y_{ij} = observed value of the variable of interest for landowner j in county I.

Two different estimators are used and are defined as follows.

For estimating population totals,

$$\hat{Y} = \frac{N}{n} \sum_{i=1}^{n} M_i \bar{y}_i$$

with standard error

$$s(\hat{Y}) = \sqrt{\frac{N^2}{n}\left(1 - \frac{n}{N}\right) \sum_{i=1}^{n} \frac{\left(\hat{Y}_i - \bar{Y}\right)^2}{(n-1)} + \frac{N}{n} \sum_{i=1}^{n} \frac{M_i^2\left(1 - \frac{m_i}{M_i}\right) s_i^2}{m_i}}$$

where

$$\bar{y}_i = \sum_{j=1}^{m_i} \frac{y_{ij}}{m_i}$$

$$\hat{Y}_i = M_i \bar{y}_i \quad \textit{and}$$

$$s_i^2 = \sum_{j=1}^{m} \frac{\left(y_{ij} - \bar{y}_i\right)^2}{\left(m_i - 1\right)}$$

The estimator for the total, $\hat{Y}$, is unbiased and allows estimation of the population total without knowledge of the total number of land owners in all the counties in the population $\left(\sum_{i=1}^{N} M_i\right)$ which is unknown in this survey. Note that this is different from the total number of counties sampled $\left(\sum_{i=1}^{n} M_i\right)$ which we are able to estimate from the sampled data. Hence, this estimator can not be used to estimate population means. Instead, for this we use

a ratio estimator defined as

$$\hat{\bar{y}} = \frac{\sum_{i=1}^{n} M_i \bar{y}_i}{\sum_{i=1}^{n} M_i}$$

with standard error

$$s\left(\hat{\bar{y}}\right) = \frac{1}{\hat{M}_o}\sqrt{\frac{N^2}{n}\left(1-\frac{n}{N}\right)\sum_{i=1}^{n}\frac{M_i^2\left(\bar{y}_i-\hat{\bar{y}}\right)^2}{n-1} + \frac{N}{n}\sum_{i=1}^{n}\frac{M_i^2\left(1-\frac{m_i}{M_i}\right)s_i^2}{m_i}}$$

where

$$\hat{M}_o = N\,\frac{\sum_{i=1}^{n} M_i}{n}$$

A complication developed in estimating the standard error of the total or mean whenever a county had only one observation ($m_i = 1$). In this case s_i^2 which is required for the formula can not be estimated. To alleviate this problem the term on the far right of each standard error formula was deleted.

DETERMINATION of Mij

To be able to estimate means and totals in two-stage sampling, the M_{ij} must be known

where

M_{ij} = the total number of land owners in county I and tract size category j.

Note that the M_{ij} are the total number of land owners in county I and tract size category j as opposed to the number m_{ij} sampled in the county with a questionnaire. Theoretically, for two-stage sampling the M_{ij} should be known quantities, however, in this study they were unknown so a sampling scheme for estimating the M_{ij} was developed which was based on an approximate random sample at the tax office through use of FORM 2. Originally it was anticipated that an estimate of M_{ij} would be

$\hat{M}_{ij} = CAT_{ij} / (THICKNESS_i / 100)$

where

CAT_{ij} = number of sampled land owners (tax office and FORM 2) in county I who are in tract size category j and

$THICKNESS_i$ = the percent of the tax book used to get the sample of land owners in county I.

However, due to difficulties with the THICKNESS estimate, such as the inability of the tax office to estimate THICKNESS accurately, the resulting estimates of the M_{ij} were questionable. For instance, using the above estimated M_{ij} for the four tract size categories within a county lead to estimates of total county acreage which deviated considerably from accurate estimates of total private county acreage obtained by NRI. Thus, it was decided to use an alternative estimation method which used the reliable NRI estimate of total acreage in a county instead of the questionable THICKNESS estimate along with estimates of the average tract size and proportion of land owners in each of the four category groups for each county to estimate the M_{ij}. For a given county I, let

NRI_i = the total private acres in county I based on the NRI estimate,

$\bar{y}_{ij}$ = the average tract size (acres) for a land owner in county I and tract size category j (obtained from the land owner questionnaire) and

p_{ij} = an estimate of the proportion of land owners in county I who are in tract size category j (obtained from the tax office and FORM 2).

Then the total private acres in county I is defined by the relationship

$$\sum_{j=1}^{4} M_{ij}\,\bar{y}_{ij} = NRI_i \qquad (1)$$

and the number of land owners in county I and tract size category j is

$$M_{ij} = M_i\, p_{ij} \qquad (2)$$

where

M_i = the total number of land owners in county I (an unknown).

Thus, substituting equation 2 into equation 1 we have

$$\sum_{j=1}^{4} M_{ij}\,\bar{y}_{ij} = \sum_{j=1}^{4} M_i\, p_{ij}\,\bar{y}_{ij} = M_i \sum_{j=1}^{4} p_{ij}\,\bar{y}_{ij} = NRI_i \qquad (3)$$

which, upon rearranging equation 3, yields an estimator for M_i as

$$\hat{M}_i = NRI_i \,/\, \left(\sum_{j=1}^{4} p_{ij}\,\bar{y}_{ij} \right) \qquad (4)$$

which can be substituted into equation 2 to yield an estimate of M_{ij}. Note that by constraining the estimate of total acres in county I to be equal to NRI's, estimates of p_{ij} and $\bar{y}_{ij}$ were used to estimate the M_{ij}.

Occasionally FORM 2 yielded a $p_{ij} = 0$ which may have been either the true value or zero just because only 100 land owners were sampled. Thus, two other pieces of information were used to correct for the latter situation. First, the original returned land owner questionnaire data was checked for any valid returns in the appropriate county and tract size category. If there were some, then obviously $p_{ij} = 0$ is in error and p_{ij} was assigned the average of the Division and tract size category. Second, the county "experts" were questioned on FORM 2 as to whether there were any tract size 4's in their county. If they answered yes (NO500 ne missing), then obviously $p_{ij} = 0$ and $\bar{y}_{ij}$ = missing are both in error for tract size category 4. This was also assumed for the other tract size categories if their $p_{ij} = 0$ and $\bar{y}_{ij}$ = missing and there were tract size 4's in the county which implies that the smaller tract size categories were also present. Thus, in this case p_{ij} and $\bar{y}_{ij}$ were assigned the average values for their Division and tract size category. Summarizing, we have the following:

1. If (p_{ij} ne 0) and ($\bar{y}_{ij}$ = missing) then assign $\bar{y}_{ij}$ the mean value
2. If ($p_{ij} = 0$) and ($\bar{y}_{ij}$ ne missing) then assign p_{ij} the mean value
3. If ($p_{ij} = 0$) and ($\bar{y}_{ij}$ = missing) and (NO500 = missing) then $\bar{y}_{ij} = 0$
4. If ($p_{ij} = 0$) and ($\bar{y}_{ij}$ = missing) and (NO500 ne missing) then assign p_{ij} and $\bar{y}_{ij}$ the mean value

where the mean value is for the appropriate Division and tract size category (Table 1). In addition, when correcting the p_{ij} as above, the sum of p_{ij} over j for county I will sum to over 1.0. In this case the p_{ij} were conditioned to 1.0 by dividing each p_{ij} by the sum of p_{ij} over j.

Table 1–The mean values for p_{ij} and $\bar{y}_{ij}$ on a Division and tract size category basis.

Division	Category	p_{ij}	$\bar{y}_{ij}$
210	1	0.32174	13.13
210	2	0.55981	45.94
210	3	0.11264	186.48
210	4	0.00582	867.10
220	1	0.24353	13.98
220	2	0.57441	49.53
220	3	0.17409	183.83
220	4	0.00797	1026.97
230	1	0.25389	13.77
230	2	0.52101	47.71
230	3	0.20090	197.17
230	4	0.02420	1393.09
240	1	0.26561	12.71
240	2	0.50805	42.31
240	3	0.18318	208.50
240	4	0.04315	4165.67
250	1	0.10848	13.08
250	2	0.53249	61.35
250	3	0.34730	214.50
250	4	0.01172	972.76
310	1	0.19434	14.03
310	2	0.38034	59.07
310	3	0.34200	235.85
310	4	0.08331	4110.82
320	1	0.21974	14.19
320	2	0.46074	45.65
320	3	0.25644	232.14
320	4	0.06308	3846.20
330	1	0.07853	13.83
330	2	0.31767	54.43
330	3	0.52207	225.87
330	4	0.08173	2081.34
340	1	0.17465	12.85
340	2	0.43084	46.38
340	3	0.29261	231.22
340	4	0.10190	3494.88

DETERMINATION of N and n for each BAILEY'S DIVISION

To estimate totals in two-stage sampling, one must know N for each Division where

N = the total number of counties in the given Bailey Division.

Note that N is the total number of counties in the given Bailey Division as opposed to the number of counties sampled which is n. Theoretically, this should be a known quantity from which a sample of size n is drawn. Then, to estimate the Division total, it's merely the total estimate for those counties sampled times an expansion factor which is the quotient of the total number of counties in the Division divided by the number of counties sampled, that is, N / n. The known number of counties in each Division could easily be obtained from standard atlas maps of the U.S. In this study, the expansion factor is approximately 4.0 since about 25 percent of the counties were sampled, that is, n = 0.25 N. However, upon data analysis it became evident that for some counties in tract size category 4 there were no land owner questionnaire returns. This could be due to one of the following reasons:

1. The county did not have any land owners in tract size category 4 (the county is not in the population and, thus, not in the sample)
2. These land owners were not sampled (the county is in the population but not in the sample)
3. These land owners never responded to the questionnaire (the county is in the population and in the sample but there were no returns due to response neglect).

Hence, the N should be adjusted downward due to reason 1 above since the given county does not comprise the population which was sampled. To include it would artificially increase the total estimate. Reasons 2 and 3 are not justification for decreasing N. It was also believed that tract size categories 1, 2 and 3 would always have land owners and so no adjustments were made to N for these. To estimate the reduction factor for tract size category 4 the M_{i4} were used. Given the total number of counties N in a given Division and tract size category 4, let

p_i = the proportion of counties in the given Division which had at least one land owner M_{i4} in tract size category 4

then $N_i = p_i \ N$. This procedure resulted in the adjusted N_i in Table 2.

The total number of counties sampled, n, is also required for estimation purposes. However, this is not necessarily the number of counties in which questionnaires were sent since it is conceivable that no responses may have been obtained from land owners in certain counties and tract size categories. Hence, a county was considered sampled for a specific tract size category only if it had at least one returned land owner questionnaire.

Table 2–The total number of counties, N_i , in each Bailey's Division for each tract size category.

	Tract Size Category	
Bailey's Division	1, 2 and 3	4
210	177	147
220	819	679
230	677	551
240	73	65
250	436	342
310	175	175
320	36	27
330	389	381
340	76	72